CLAIMS

We claim:

1. A method of identifying internal tissue of an internal organ of a patient comprising the steps of:

inserting a probe into the patient and into an internal area of the organ;

illuminating the internal area of the internal organ against the probe with light carried through the probe;

collecting with the probe light returned from the illuminated tissue;

identifying particular spectral intensity magnitude values using a light detector; and

using one or more of the identified spectral values to identify the illuminated tissue as undenatured non-tumorous, undenatured tumorous or denatured tissue.

2. The method of claim 1 wherein the identifying step comprises converting the collected light with a spectrometer into a plurality of discrete spectral intensity values.

3. The method of claim 1 further comprising of steps of moving the probe incrementally along a path extending at least into the organ; and repeating the illuminating, collecting, identifying and using steps at spaced intervals along the path to identify organ tissue along the path.

4. The method of claim 3 further comprising the step of using the tissue identifications at the spaced intervals to determine a location of a tumor within the organ along the path.

5. The method of claim 4 further of comprising the step of locating a thermal coagulation device in the organ with respect to the tumor using the tumor location determined in the last stated using step.

6. The method of claim 5 further comprising the steps of:

locating an optical sensing end of the probe in non-tumorous tissue adjoining the tumor so as to sense the non-tumorous tissue adjoining the tumor;

thermally coagulating the tumor with the thermal-coagulation device; and

monitoring progress of coagulation of tissue from the tumor into the non-tumorous tissue being sensed by the probe during the thermally coagulating step.

7. The method of claim 1 wherein the steps are performed after thermal coagulation of a tumor within the organ and wherein the inserting step comprises of the step of moving probe along a path through the organ and repeating the illuminating, collecting, identifying and using steps at spaced intervals along the path to identify tissue as coagulated or uncoagulated at the spaced intervals along the path.

8. The method of claim 7 further comprising the step of using the tissue identifications at the spaced intervals to locate a mass of coagulated tissue within the organ.

9. The method of claim 1 wherein the illuminating step comprises providing through the probe, light from a source with at least an ultraviolet component sufficient to induce autofluorescence in the illuminated tissue.

10. The method of claim 1 wherein the illuminating step comprises providing through the probe, light from a source with a component at least within the range of from about 650 nm to about 750 nm sufficient to illuminate changes in diffuse reflectance occurring between tumorous and non-tumorous organ tissues.

11. A method of diagnosing thermal denaturation of liver tissue comprising the steps of:

locating an optical probe in the tissue in an area immediately adjoining a portion of the tissue to be thermally denaturated;

illuminating tissue immediately adjoining the probe with the probe and collecting with the probe light returned from the illuminated tissue;

converting the collected light with one or more light detectors into a plurality of discrete spectral intensity values; and

using at least a subset of the plurality of discrete spectral intensity values during a thermal denaturation treatment to diagnose denaturation of the illuminated tissue over time.

12. The method of claim 11 wherein the illuminating step comprises providing through the probe, light from a source with at least an ultraviolet component sufficient to induce autofluorescence in the illuminated tissue.

13. The method of claim 12 wherein the collecting step comprises collecting autofluorescence light emitted by the illuminated tissue.

14. The method of claim 11 further comprising before the using step, a preliminary steps of identifying a first wavelength having a maximum intensity value of the plurality; and wherein the using step comprises a step of monitoring a spectral correlate value changing with changes in intensity values of the first wavelength during the thermal denaturation treatment.

15. The method of claim 14 further comprising as part of the preliminary step, pre-selecting a second spectral intensity segment greater in wavelength than the first wavelength and wherein the using step comprising a step of computing ratios of the intensities of the first and second wavelengths over time and using the ratios to diagnose progressive thermal denaturation of the illuminated tissue.

16. The method of claim 15 wherein the preliminary step of pre-selecting the second wavelength further comprises selecting a second wavelength no greater than 50 nm above the first wavelength.

17. The method of claim 15 wherein the step of pre-selecting the second wavelength further comprises selecting a second wavelength greater than 100 nm and no greater than 150 nm above the first wavelength.

18. The method of claim 14 wherein the first wavelength is between 450 and 500nm.

19. The method of claim 14 wherein the preliminary step comprises identifying a second wavelength of about 30 nm or about 130 nm greater than the first wavelength and wherein the using step comprises monitoring changes in the second wavelength during the denaturation treatment.

20. The method of claim 19 wherein the using step comprises computing ratios of the first wavelength intensities values with the second wavelength intensities values and monitoring changes in the ratios during the denaturation treatment.

21. The method of claim 20 wherein the computed ratios are of the second wavelength intensity values to the first wavelength intensity values and are normalized to an initial ratio value.

22. The method of claim 11 wherein the illuminating step comprises providing to the probe light from a source sufficient to induce diffuse reflectance in a spectral range at least partially overlapping a range between 650 nm and 850 nm.

23. The method of claim 22 wherein the collecting step comprises collecting diffuse reflectance light while the tissue is being illuminated.

24. The method of claim 23 wherein the monitoring step comprises monitoring diffuse reflected intensity values over time during the denaturation treatment for at least one wavelength in a range of 650 nm to 850 nm.

25. A medical tissue ablation system including a tubular member configured for introduction into a patient and having one or more ablation electrodes extending therethrough and individually deployable from a distal open end of the tubular member into an ablation site within the patient, each of the ablation electrodes being coupled with an ablation energy source, characterized by:

a spectrometer; and

at least a first optical fiber encased in a first tubular needle extended through the tubular member with the one or more ablation electrodes and individually extendable from the distal open end of the tubular member into the patient at least proximal to the ablation site, the optical fiber having a first, distal end exposed to light through a first distal open end of the first tubular needle and a second, proximal end optically coupled with the spectrometer so as to deliver to the spectrometer, light collected through the first end of the optical fiber.

26. The system of claim 25 further characterized by: a light source; and at least a second optical fiber having a first distal end extended through the tubular member and from the distal open end of the tubular member into the patient at least proximal to the ablation site and having a second, proximal end optically coupled with the light source.

27. The system of claim 26 further characterized by the light source emitting at least ultra violet light sufficient to induce autofluorescence in tissue illuminated by the second optical fiber.

28. The system of claim 26 further characterized by the light source emitting at least light within a range of between 320 nm and 360 nm sufficient to induce autofluorescence in tissue illuminated by the second optical fiber.

29. The system of claim 28 further characterized by the light source being a laser.

30. The system of claim 26 further characterized by the light source emitting light in a range at least between about 650 nm and about 750 nm to generate diffuse reflectance in tissue illuminated by the light source and the second optical fiber.

31. The system of claim 30 further characterized by the light source being a white light source.

32. The system of claim 31 further characterized by the light source being a halogen lamp.

33. The system of claim 26 further characterized by the second optical fiber being extended through the first tubular needle with the first optical fiber to the first distal open end of the first tubular needle.

34. The system of claim 25 further characterized by the first tubular needle being coupled with the ablation energy source.

35. The system of claim 34 further comprising a thermally insulating cover on the distal end of the tubular needle.

36. The system of claim 34 further comprising a transparent cover over at least the open distal end of the tubular needle.

37. The system of claim 25 further characterized by the second optical fiber having a first distal end being encased in a second hollow needle extended through the tubular member and from the distal open end of the tubular member into the patient at least proximal to the ablation site.

38. The system of claim 37 further characterized by a second distal end of the second tubular needle being coupled with the ablation energy source.

39. The system of claim 38 further comprising a thermally insulating cover on the distal end of the tubular needle.

40. The system of claim 37 further comprising a transparent cover over at least the open distal end of the tubular needle

41. The system of claim 37 further characterized by the light source being configured to induce autofluorescence in tissue illuminated by the first end of the second optical fiber.

42. The system of claim 37 further characterized by the light source emitting light at least within a range of between 320 nm and 360 nm sufficient to induce autofluorescence in tissue illuminated by the second optical fiber.

43. The system of claim 37 further characterized by the light source being a laser.

44. The system of claim 37 further characterized by the light source having a spectral component at least in the range of 650 nm to 850 nm.

45. The system of claim 37 further characterized by the source being a white light source.

46. The system of claim 37 further characterized by the source being a halogen lamp.